

Pine Snake and Timber Rattlesnake Surveys on the Aerohaven Site in Evesham Township, Burlington County, New Jersey



Diverse habitats on the Aerohaven site

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to

**Evesham Township
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INTRODUCTION

Evesham Township has proposed the construction of a municipal park in the southern portion of the township. Two parcels are being considered for this project. One site is a formerly proposed residential housing development called Kings Grant - Phase II. This site is approximately 200 acres of a 711 acre area in Block 52, Lot 1. The second site is Aerohaven, a 212 acre area that consists of an abandoned airplane runway, disturbed areas, pine dominated woodlands, and freshwater wetlands. Aerohaven is contiguous with and immediately to the south of the former Kings Grant - Phase II site, and is located in Block 57, Lots 1 and 2. Together, these two sites contain approximately 412 acres, of which 256 acres are developable. The Aerohaven Landfill, operated by Owens Coming, is adjacent to the Aerohaven site and is situated to its south. **Figure 1** shows the boundary of the Aerohaven site.

Herpetological Associates, Inc. was contracted by Evesham Township to conduct an initial habitat evaluation (Phase I) for the northern pine snake (*Pituophis melanoleucus*) and the timber rattlesnake (*Crotalus horridus*) on the Aerohaven site during 2000. The results of the habitat evaluation were submitted on November 2, 2000. During the Phase I study, it was determined that habitat was present for the northern pine snake and the timber rattlesnake. Based on the potential observed for the pine snake and timber rattlesnake on the study site, HA recommended that a Phase II presence or absence study be conducted during 2001.

Phase II surveys were initiated in 2001, with the intention of determining the presence or absence of the northern pine snake and timber rattlesnake. An attempt was also made to gain preliminary information on population size and the extent of habitat use if either species was found. This report presents the results of HA's investigation.



Northern Pine Snake (*Pituophis m. melanoleucus*)

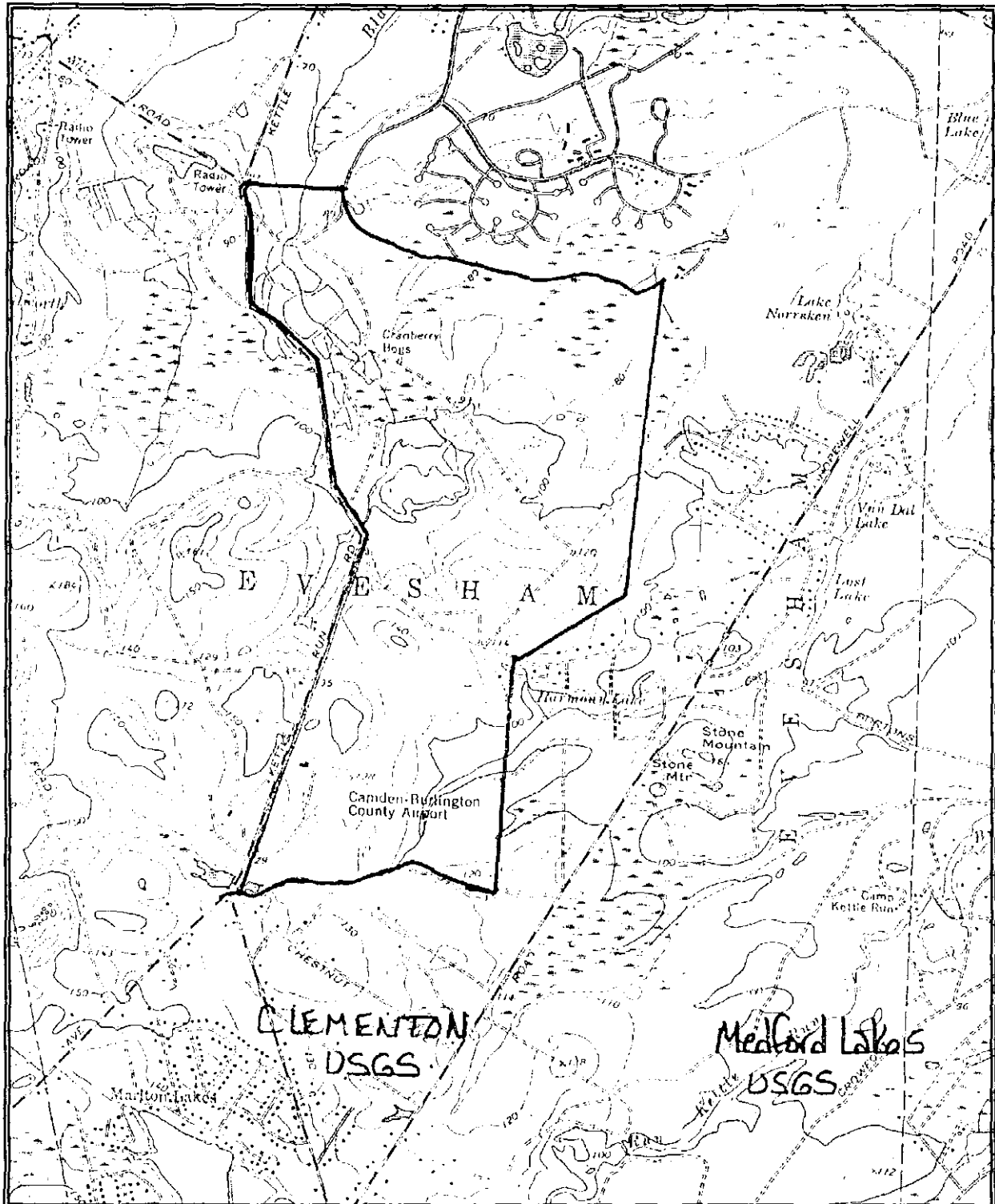


Figure 1. USGS topographic map showing the location of the Aerohaven study site. Boundaries of the study site are indicated by the black polygon.

MATERIAL AND METHODS

Reptiles and amphibians are **often** difficult to census due to their highly secretive nature and **ability** to remain hidden for long periods of time. Environmental conditions such as temperature, precipitation, soil moisture, humidity, **light** intensity, wind, and season also have strong **influences** on reptile and amphibian activity patterns (Vogt and Hine, 1982). Unsuitable weather conditions may lead to increased fossorial behavior, markedly reduced activity, **shifts** in habitat types used, and/or estivation. Therefore, the use of several sampling techniques which take into account the various aspects of an animal's biology often result in the best assessment of species abundance and richness.

Visual Search Techniques

Time Constrained Technique. In this method, a **specific** habitat is selected (e.g., oak/pine forest, pine/oak forest, wetland corridor) and all potential hiding places for reptiles and amphibians are searched. **Fallen** logs, stones, and leaf litter are overturned, as well as artificial hiding places such as discarded sheets of wood or metal, rugs, furniture, etc. Open, sunny areas are searched for surface active or basking snakes and lizards. Wetlands are searched particularly for **frogs** and salamanders, either active or concealed, although a variety of herptiles are **often** encountered in wet areas. Depending on the number of times an area is to be searched, all individual reptiles and amphibians encountered may be uniquely marked to avoid counting animals twice and/or to obtain a population estimate. Spatial boundaries for each search may **be** set, or maybe based on the selected habitat type. Time limits are set, ensuring that each habitat is adequately examined (Campbell and Christman, 1982; Karns, 1986).

Random Opportunistic Sampling. A relatively simple method for the trained herpetologist, Random Opportunistic Sampling can be employed while performing other sampling techniques on the study site. This involves searching various areas of the site which show potential habitat for a species of interest, or areas which are conveniently accessible. Locations on-site which do not **fall** into any specific habitat classification (e.g., disturbed areas, garbage dumps, etc.) may generate previously undiscovered species that would not have been found without the use of this method. All herptiles encountered are recorded to supplement the species list generated by other field methods. This method is effective **if there** are no time constraints on the survey and the survey area is visited **often**. Qualitative impressions can be developed as to the relative abundance and habitat use of certain species (Campbell and Christman, 1982; Karns, 1986).

Diurnal and Nocturnal Road Cruising. Road cruising can be used passively, such as **while** driving to and **from** a site or while driving/walking to and from areas on the site, or it can be initiated as a specific surveying technique. This method involves driving a vehicle at slow speed or **walking** along paved roads or sand trails at various times of the day and/or night. Road cruising is **often** highly productive on **warm**, humid or rainy spring nights, or during other high activity times of the year (depending on the species). Animals moving across roads can be easily identified and/or captured. In addition, roads which border potential habitat **often** yield dead reptiles or amphibians or other

animals, killed as they attempt to cross. These “road-killed” animals can be **identified** and provide useful information on migration routes, activity patterns, and habitat utilization/partitioning. The basic presence or absence of a species in a particular area can also be determined by the identification of their remains (Karns, 1986).

Permanent Marking Techniques for Snakes

Electronically-read implantable, glass-encapsulated AVID Identification tags are used to mark any State-listed snake species. Each tag has a unique 9-digit number, allowing quick, easy, accurate **identification of any** marked animal. The AVID ID tags are **small**, measuring 14 mm x 2.1 mm (.55 in. x .08 in.) and weighing 0.08 grams (0.0028 oz.), which allows their use even in large neonate snakes (such as pine snakes and timber rattlesnakes). The ID tags are hermetically sealed in biocompatible glass and have an anti-migratory coating of **parylene**, enabling them to be injected subcutaneously or intramuscularly using a 3/4 in. 12 gauge needle. The power requirements of the tags are passive, meaning that they are activated by the electromagnetic field of the portable AVID reader. The **life expectancy of the** AVID ID tags is estimated at over 100,000 reads, which is **well** above the needs of the researcher within the life expectancy of the study animal(s).

Data Collected on Snakes

Body measurements are taken upon the initial capture or subsequent recapture of any state-listed species using a squeeze box and cartometer or manipulation along a **meter** stick (modified from Quinn and Jones, 1974). Weight is determined using an Ohaus triple beam balance. Sex is determined by probing (**Schaffer, 1934**), counting subcaudal scales, **and/or** by noting sexually dimorphic characteristics. The reproductive condition of adult female snakes was assessed visually or by palpation of the posterior ventral region of the body (bulging eggs).

Radiotracking

Radiotracking is a method used to monitor the behavior of tree-ranging pine snakes. The transmitter packages are specially designed by HA, since commercially available transmitter packages are normally constructed for use with mammals or birds and are generally unsuitable for use with snakes (Reinert, 1992). Typically, AVM Instrument Co. **SM11.5V** or G3 3V units are used. Transmitter are designed so that their mass represents less than 3% of the snakes mass. The typical range of the transmitters is 400 to 1000 m. Potted units are surgically implanted in the coelomic cavity following the general procedure described by Reinert and Cundall (1982), with recent improvements and modifications (Reinert, 1992). All surgical procedures are performed by the investigators. The relocations of the snake are plotted on a base map of the study site.

HA originally planned to radiotrack up to six pine snakes and timber rattlesnakes, but only one was monitored. We were unable to obtain the necessary permits **from** NJDEP to implant all of the adult pine snakes that were captured.

RESULTS

Visual Search

Surveys were conducted at the Aerohaven site between April 28, 2001 and October 14, 2001 (Table 1). Seventeen reptile and amphibian species were found on the site (Table 2). No timber rattlesnakes were found during the survey period, but seven northern pine snakes were found on the Aerohaven site (Table 3). The location of each pine snake capture is plotted on an aerial photograph (Figure 2).

Of the seven pine snakes, four were marked and released. These included three adult females and one adult male. None of the marked snakes were recaptured. Three additional pine snakes were observed on the Aerohaven site, but were not marked. One of these snakes was an adult male that escaped capture under a large slab of concrete on June 18, 2001. The second snake was a hatchling, born in 2001. It was found at a nesting site on September 8, 2001 at the entrance of a burrow, alongside several recently shed skins of its siblings. The location of the nest site is shown on Figure 2. The third pine snake was also a hatchling, and was found under a piece of metal at the southern end of the site on October 14, 2001.

Eight shed skins of pine snakes were also found on the Aerohaven site during the 2001 surveys. Six of these sheds were from adult snakes and two were from hatchlings. The hatchling shed skins were found alongside a hatchling pine snake on September 8, 2001, as described above.

Radiotracking

One adult female pine snake, field number 2001.01, was captured on May 10, 2001 and implanted with a radiotransmitter on May 11, 2001. The snake was relocated twelve times between May 28, 2001 and September 8, 2001. All telemetry locations are plotted on an aerial photograph (Figure 3). Eight of the relocations were on the Aerohaven site and four of the relocations were OR the Owens Corning property. Any time the snake was tracked to the Owens Corning property, its position was triangulated from points on the Aerohaven site or from public roads. Since Owens Corning would not give HA permission to enter their property, no attempt was made to access the Owens Corning land in 2001.

Habitat use on the Aerohaven site by the radiotracked pine snake was largely restricted to the disturbed portions of the site. Although the snake was never seen on the surface after its release, the transmitter signal was precisely located on every instance except when she moved to the Owens Corning property. Microhabitats used by the pine snake included several man-made features, such as cement piles, stump piles, and concrete foundations. A summary of the radiotracking results is presented in Table 4. Unfortunately, the snake was lost after September 8, 2001. No signal was received on any subsequent site visits, although numerous attempts were made to relocate the snake. Therefore, the location of the overwintering site was not able to be determined.

Table 1. Dates and conditions of surveys during 2001.

| Survey Date | Weather | Ambient Temp. ("C) | Relative Humidity |
|--------------------|-------------------|---------------------------|--------------------------|
| 04/28/01 | Sunny | 22.3 | 24% |
| 05/10/01 | sunny | 28.3 | 32% |
| 05/15/01 | Sunny, windy | 22.1 | 26% |
| 05/17/01 | Cloudy | 18.2 | 41% |
| 05/28/01 | S u n n y | 29.9 | 34% |
| 06/08/01 | Sunny | 22.7 | 43% |
| 06/18/01 | Sunny | 32.0 | 31% |
| 06/24/01 | Sunny | 28.2 | 44% |
| 07/01/01 | Partly cloudy | 35.2 | 45% |
| 07/11/01 | Partly cloudy | 27.9 | 55% |
| 07/15/01 | Sunny | 29.6 | 36% |
| 07/17/01 | Sunny | 32.2 | 49% |
| 07/21/01 | Partly cloudy | N/A | NIA |
| 07/31/01 | Sunny | 31.3 | 56% |
| 08/05/01 | Clear | N/A | NIA |
| 08/25/01 | Sunny, light wind | 29.1 | 43% |
| 08/31/01 | Sunny, light wind | 30.1 | 54% |
| 09/08/01 | Sunny | 24.4 | 69% |
| 10/14/01 | Mostly cloudy | 24.7 | 51% |

Table 2. Reptiles and amphibians observed between April 28 and October 14, 2001 on the Aerohaven site.

| Common Name | Scientific Name | Number Observed |
|-------------------------|--|------------------|
| Snakes | | |
| Northern pine snake | <i>Pituophis m. melanoleucus</i> | 7 + 8 shed skins |
| Northern black racer | <i>Coluber c. constrictor</i> | 3 + 1 shed skin |
| Black rat snake | <i>Elaphe obsoleta</i> | 1 D.O.R. |
| Eastern garter snake | <i>Thamnophis s. sirtalis</i> | 2 |
| Rough green snake | <i>Opheodrys aestivus</i> | 2 |
| Southern ringneck snake | <i>Diadophis p. punctatus</i> | 6 |
| Northern water snake | <i>Nerodia s. sipedon</i> | 1 |
| Lizards | | |
| Fence lizard | <i>Sceloporus undulatus hyacinthinus</i> | 32 |
| Ground skink | <i>Scincella lateralis</i> | 3 |
| Turtles | | |
| Redbelly turtle | <i>Pseudemys rubriventris</i> | 1 |
| Painted turtle | <i>Chrysemys p. picta</i> | 8 |
| Box turtle | <i>Terrapene carolina</i> | 3 |
| Frogs and Toads | | |
| Green frog | <i>Rana clamitans melanota</i> | 5 |
| Bullfrog | <i>Rana catesbeiana</i> | 4 |
| carpenter frog | <i>Rana virgatipes</i> | 8 |
| Gray treefrog | <i>Hyla versicolor</i> | 2 calling |
| Fowler's toad | <i>Bufo woodhousii fowleri</i> | 12 |
| Salamanders | | |
| Redback salamander | <i>Plethodon cinereus</i> | 6 |

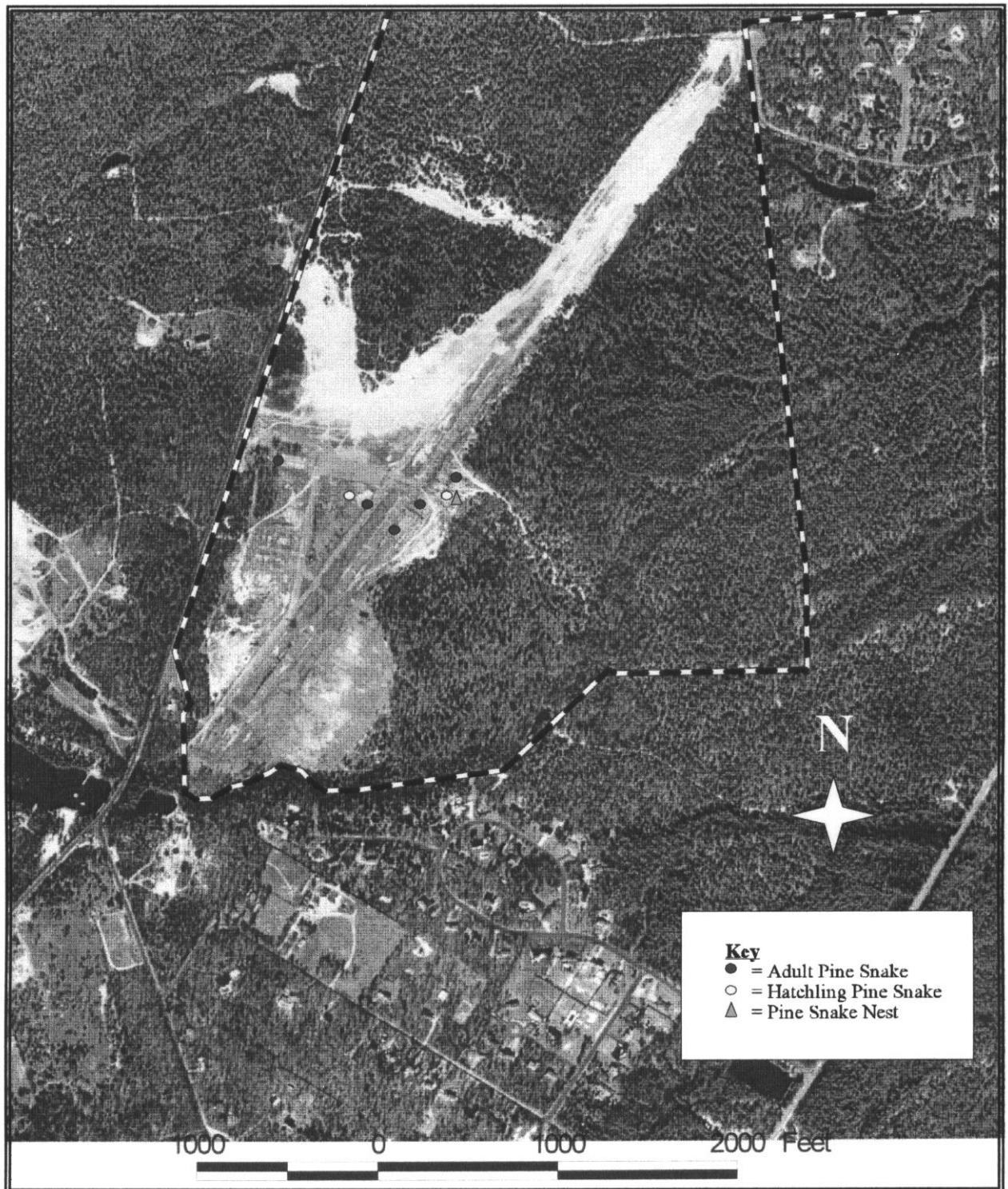


Figure 2. Locations of randomly captured pine snakes and a pine snake nest on the Aerohaven site.

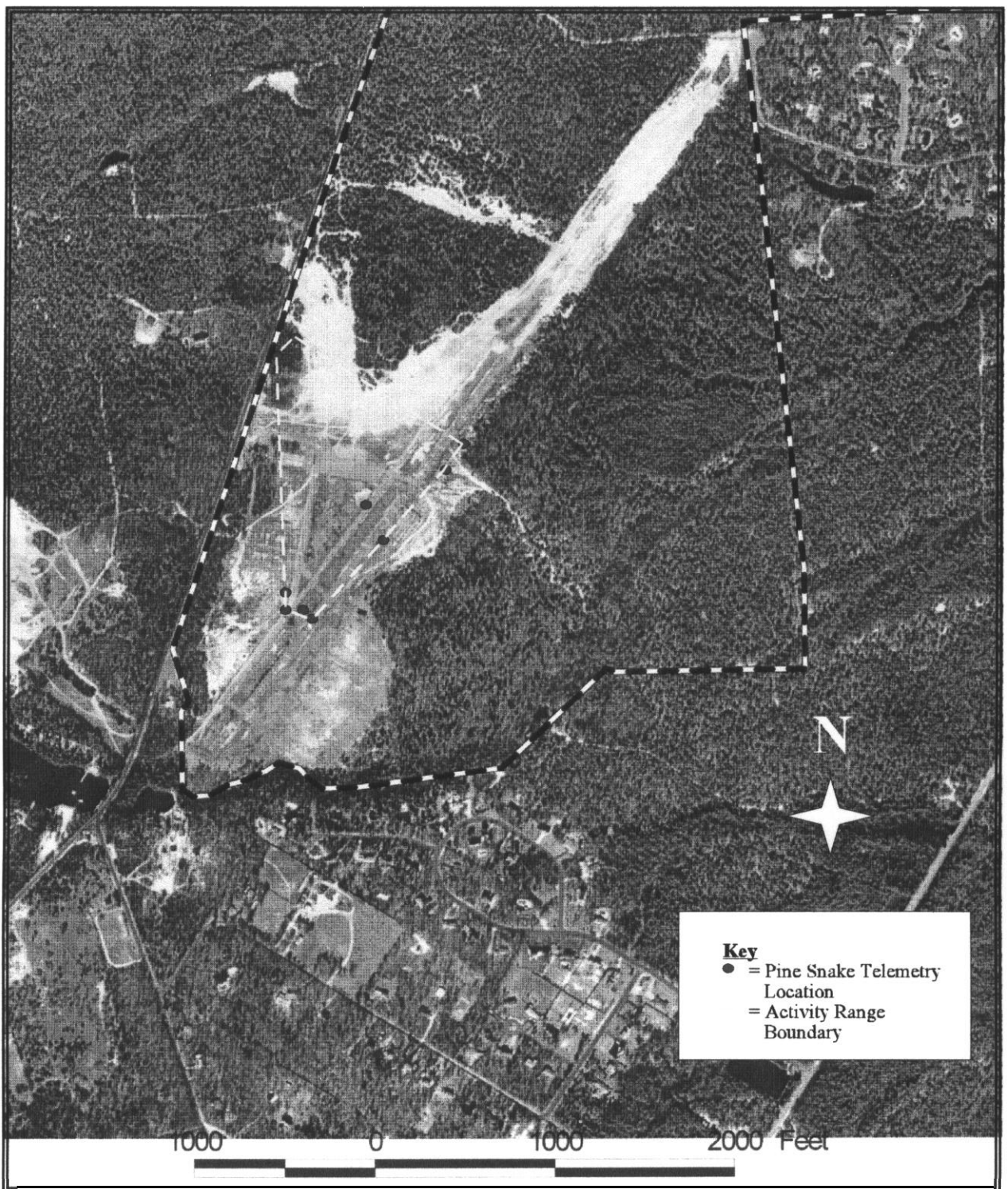


Figure 3. Telemetry locations for a female pine snake radiotracked at the Aerohaven study site. The black and white dashed line represents the property boundary.

Table 3. Pine snakes captured or observed on the Aerohaven site during 2001.

| Field No. | Date | Sex | Total Length (cm) | Weight (g) | PIT Tag No. |
|------------------|-------------|------------|--------------------------|-------------------|--------------------|
| 2001.01 | 05/10/01 | F | 161.5 | 1,304.0 | 038-804-351 |
| N/A | 06/18/01 | M | NIA | NIA | N/A |
| 2001.03 | 07/21/01 | F | 129.0 | 807.7 | 039-040-620 |
| 2001.04 | 07/31/01 | M | 166.6 | 1,666.6 | 038-797-888 |
| 2001.05 | 09/08/01 | F | 148.1 | 1,158.0 | 039-033-259 |
| N/A | 09/08/01 | H | NIA | N/A | N/A |
| N/A | 10/14/01 | H | NIA | N/A | N/A |

N/A = Data not available, snakes were not processed.

H = Hatchling, sex not determined.

Table 4. Radiotracking data from the Aerohaven site in 2001.

| Date | Property | Habitat Type | Microhabitat |
|-------------|------------------|---------------------------------|-----------------------------|
| 05/28/01 | Owens Corning | Disturbed field | Log pile, man-made |
| 06/08/01 | Aerohaven | Disturbed field | Pile of cement blocks |
| 06/18/01 | Aerohaven | Disturbed field | Pile of cement blocks |
| 06/24/01 | Aerohaven | Disturbed field | Pile of cement blocks |
| 07/01/01 | Aerohaven | Disturbed field | Stump pile, man-made |
| 07/11/01 | Aerohaven | Shrub/scrub, <i>Smilax</i> area | Leaf litter |
| 07/15/01 | Aerohaven | Disturbed field | Mammal burrow |
| 7/17/01 | Aerohaven | Disturbed field | Stump pile, man-made |
| 07/31/01 | Owens Coming | Disturbed field | Unknown |
| 08/05/01 | Last - No signal | N/A | NIA |
| 08/25/01 | Owens Coming | Disturbed field | Unknown |
| 08/31/01 | Owens Coming | Disturbed field | Unknown |
| 09/08/01 | Aerohaven | Shrub/scrub, <i>Smilax</i> area | No visual on snake, unknown |

Note: Each date represents a specific telemetry relocation for the study specimen. “Property” refers to the specific site where the snake was located on that date; either the Owens Coming landfill site or the Aerohaven study site. “Habitat Type” refers to the major habitat classification surrounding the snake, and “Microhabitat” refers to the specific habitat feature(s) within a habitat type at the snake location.

DISCUSSION

Habitat Use by Timber Rattlesnakes and Pine Snakes at the Aerohaven Site

No timber rattlesnakes were **confirmed** on the study property, despite the fact that suitable habitat is present. Although timber rattlesnakes are known from nearby areas along Kettle Run Creek, including an area immediately across **Hopewell Road**, it seems unlikely that the Aerohaven site serves as important timber rattlesnake habitat. The presence of **Hopewell Road** probably serves as a significant barrier to snake movement, separating the viable population along Kettle Run Creek from the study site.

This study has **confirmed** that a population **of the** State-threatened northern pine snake exists on the Aerohaven site. The presence of hatchlings and young adults indicates that successful reproduction and recruitment is occurring. The majority **of the** specimens were found in and around the old airport runway, due in part to the conditions that exist there. In the time since the demolition and removal **of the** structures and runways at the Aerohaven site, the area has progressed into an early succession field stage. Several piles of concrete block and old foundations are still present, which serve as excellent cover for snakes (**Figures 4-7**). These features, in combination with the sandy soil and surrounding pine-dominated forest, have created highly suitable habitat for the pine snake. Through studies conducted on pine snakes throughout the New Jersey Pine Barrens, pine snakes have been documented to frequent disturbed areas (Zappalorti and Burger, 1985). This population has likely been rebounding in numbers since the airport was abandoned.

Only a **superficial** picture of the extent of habitat use at the study site was obtained through this study. The locations **of pine** snake captures are within the disturbed areas of the Aerohaven site (**Figures 8 and 9**), although it is likely that foraging habitat and overwintering sites exist within the forested portion of the site and areas surrounding the site. A single pine snake nest was found (**Figures 2, 9 and 10**), although additional nests probably exist but were not observed. Nesting areas are typically considered critical habitats due to the perennial use of these specific areas by individual females (see pine snake life history, below).



Figure 4. A pine snake in a pre-shed condition basking next to a concrete slab. This snake can quickly escape predators by crawling into the burrow beneath the concrete, as evident in this photo.

Radiotracking data is limited to one pine snake at this site because permission was not granted from NIDEP to use a larger sample. The small amount of data that HA was able to obtain from the one implanted pine snake indicates that the disturbed areas of the Aerohaven site and areas **within** the Aerohaven Landfill, owned by Owens Corning, serve as a major portion of its activity range (**Figures 3 and 11**). However, care should be used when interpreting this data as it only represents a few telemetry relocations from a single member of a larger pine snake population.

Two problems currently face the pine snakes at the Aerohaven site. Heavy use by off-road vehicles in the sandy, barren portions of the site is preventing vegetation from becoming established in some areas. This limits the value of the area for pine snakes. However, it is expected that some grasses will gain a foothold over time. In addition, continued use by off-road vehicles within pine snake habitat increases the chance of accidental or intentional mortality **of pine** snakes. A second problem is illegal collecting. On two separate instances, people were observed on the Aerohaven site with snake hooks and bags. Evidence that several large pieces of concrete were overturned was also found, most likely in an attempt to capture a hidden pine snake. No one was observed capturing or harassing a pine snake, nevertheless HA **notified** NIDEP conservation officers of our observations on the Aerohaven site. Illegal collecting can ultimately affect the viability of some pine snake populations, particularly if **they** are small or isolated populations.



Figure 5. Piles of block amid the open fields provide excellent opportunities for concealment and basking on the Aerohaven site.



Figure 6 The radiotracked pine snake was noted to be concealed in various man-made debris piles on several occasions.



Figure 7. This pine snake quickly found cover beneath this old foundation when released. It was originally captured while basking next to the foundation.



Figure 8. Overgrown fields served as highly suitable habitat for pine snakes at the Aerohaven site.



Figure 9. Man-made piles of sand and logs also provide excellent places for pine snakes to hide. HA staff herpetologist Dave Schneider is shown holding a pine snake that was captured at this mound. A pine snake nest was found at a similar location.



Figure 10. This hatchling pine snake was found at the entrance to its nest burrow on the Aerohaven site.



Figure 11. The position of the radiotracked pine snake was triangulated if it crossed onto the Owens Coming property

General Information on the Northern Pine Snake

Description

The northern **pine snake** is classified **taxonomically** into the *class Reptilia*, order *Squamata*, sub-order *Serpentes*, family *Colubridae*, genus *Pituophis*, species *melanoleucus*, and subspecies *melanoleucus* (Daudin, 1803). *P. m. melanoleucus* is a large, **powerful** constrictor reaching a length of 48-66 inches (maximum length of 83 inches). The pattern is variable, but generally consists of 25 to 35 large black or brown blotches leading down the back on a white background. The blotches tend to **be** darker and less **defined** near the head. The ventral scales **may** be immaculate white, flecked with varying quantities of black, or patterned with **differing** amounts of **pink**; combinations of black and pink are also encountered. Scales are keeled and the anal plate is single. There are 4 prefrontal scales. This snake is **often** gentle, although it may produce a loud hiss when startled.

Range

The range occupied by this subspecies in New Jersey is spotty, with isolated populations restricted to the New Jersey Pine Barrens; the next nearest population occurs in north central Virginia. Other populations are found south to South Carolina, northern Georgia, and Alabama, and west to northern Alabama and western Tennessee and Kentucky. The distribution is spotty over much of the range, except for South Carolina. Other subspecies are found through two-thirds of the western part of the country as well as Florida.

Status

Global Rank - G5T? (Globally secure, but rare in parts of range).

State Rank - S3 (Rare in state; wide distribution but small populations, or restricted distribution although locally abundant).

Federal Status - C2 (Being considered to receive endangered or threatened status; more data needed).

State Status - T (Threatened).

Habitat and Life History

These large, powerful constrictors are confined to the southern portion of the State, known as the Pine Barrens. A **true** lover of the uplands, the northern pine snake inhabits the dry pitch pine/oak areas of the Pine Barrens, away **from** the creeks and cedar swamps that are also found in this unique ecosystem. In mid-spring, usually April in New Jersey, pine snakes begin emerging from their hibernation dens. The snake itself may have excavated the den the previous **fall**; quite **often** however, it was dug years earlier by other pine snakes. These snakes den communally with other pine snakes as well as other species of snakes such as black racers and **corn** snakes. Dens are often dug at the bases of old decaying stumps or in abandoned mammal burrows. The snakes may follow the paths of rotted tap roots down to a safe, frost-free depth where they create hibernation **chambers**. In the spring the snakes remain around the den for a *short* period **of time**, until temperatures begin *to remain* consistently above the soil temperature.

Courtship and Mating

Mating may occur during the time of emergence from dens, but this behavior is not **confined** to this period. May is when HA has made most courtship and mating observations. Later in the spring and even into early summer, males may actively seek out females that are **still** leaving pheromone trails and may attempt to mate with them anytime during the spring and summer.

Nesting and Egg Laying

During the month **of June** and early July female pine snakes **find** sunny open areas where they proceed to dig meter-long horizontal tunnels ending in a chamber. The female lays 3 to 16 eggs in this chamber and then leaves. The eggs are similar to chicken eggs in size though they are somewhat more elongated and are leathery, as are most reptile eggs. The eggs hatch in about 2 months and reveal 14-to **20-inch-long** vibrantly patterned replicas **of the** parents. These **hatchlings** quickly **begin** foraging for **small** warm blooded prey.

Original Research on Nesting Behavior

Due to the lack of **scientific** literature on the nesting behavior of the northern pine snake, HA has pioneered original research on nesting behavior and nest site selection in the disjunct population of pine snakes found in the New Jersey Pine Barrens. Observations on the nesting behavior of pine snakes were made quite accidentally, as is often the case in science, **beginning** in 1977. At that time, pine snakes **were** occasionally found partially exposed on the ground, with the anterior portion of the snakes' body concealed in a tunnel. Early assumptions attributed these observations to feeding behavior, with the snake attempting to obtain small, burrowing mammals. However, as more snakes were captured and detailed observations made, it was noticed that all of the snakes burrowing into these "rodent burrows" were gravid females. It was also discovered that the snakes would **be** seen only during a three-week period and always at the same time **of the** year (June 20 through about July 10). These early observations led to intensive research, which eventually unlocked the mystery of **pine** snake nesting behavior and nest site selection.

Like those of most **other** snakes, pine snake eggs require warm conditions provided by the heat of the sun in order to incubate successfully. The adult female pine snake provides these conditions by actively selecting open, sunny locations in the forest and then digging their own **tunnel** and **nest-chamber**. Similar to other members of the genus *Pituophis*, northern pine snakes are well-equipped for this task, possessing a large, pointed, shield-like rostral scale on the tip of the snout. In order to loosen the often compacted sand, the snake uses its powerful neck muscles to dig its head into the earth. It then turns its head to one side and draws backward, forming a primitive "scoop" with its neck to excavate the loosened sand. A completed nest opening has a large dump-pile that is formed by the dragging actions of the female pine snake and is quite characteristic and noticeable by **the** trained observer. The average pine snake tunnel and nesting chamber is about one meter (3 feet) in length, but some have been found that are as long as 7 feet. Many of the nest tunnels curve to either the **left** or right. Often, it is speculated, that the curve is the result of the snake encountering an obstacle such as a root or a stone and then tries to dig around it. If not successful, the snake may abandon the tunnel and start another nearby. The average depth of the nesting chamber **from** the

surface is four to five inches, although some have been found almost a foot or more deep. Another curious feature is that all the tunnels make a downward dip six to twelve inches **from** the entrance. This “low spot” may acts as a catch **basin** for water, preventing the nesting chamber **from** becoming flooded in times of heavy rain.

Nest Site Fidelity

Through mark-recapture studies HA has discovered that a large percentage of female pine snakes return to the same general area to dig their nests. On several occasions, freshly laid eggs and the empty shells of eggs that hatched in previous years were found in the same burrow. In addition, several pine snakes were occasionally found nesting in the same burrow. Females nesting later were found to dig their own chambers off of the **first**, or main tunnel. This behavior may be attributed to decreasing the risk of predation by reducing the amount **of time** later nesting females spend exposed on the open surface. A second hypothesis for communal nesting is that siblings may nest together, and possibly with their mother. This second hypothesis is supported by observation that individually marked **hatchling** female pine snakes imprint on the nesting area **from** which they hatched, returning to this nesting area after reaching sexual maturity and preparing to lay their own eggs. Adult females have been shown to return year **after** year to the same nesting area, and often to the exact location where eggs were laid in previous years; fidelity to particular sites have been shown to last as long as 14 years. Although unknown at the present time, olfactory cues **left** by the old egg shells or the snakes themselves, chemical cues in the soil, magnetic orientation, visual orientation, or some combination **of these** may aid the snakes in **finding** original nest sites over long periods. While strong nesting fidelity has been observed with many **of the** marked snakes, there is of course some deviation, and this is necessary **if the** snakes are to expand their range and use all of the available habitat. The abandonment of long-term or parental nesting areas may be attributed to a loss of orientation, disturbance of the original nest site, natural succession of vegetation leading to excessive shading of the nesting area, or simple natural pioneering.

During early fall, pine snakes follow scent trails back to their original hibernation sites. New born of the year also follow these trails and will hibernate with the adults at these sites. Cold weather in mid October or early November promotes the descent of the snakes into the hibernation chambers, where they will remain **until** the spring thaw.

Activity Range

Through long-term radiotelemetry studies on the pine snake in New Jersey, HA has accumulated a representative sample of individual activity range sizes on this species. On average, pine snakes use about 125 acres of habitat, although activity ranges **of nearly** 400 acres have been documented (Table 5). In any given population, these activity ranges may or may not overlap, thus generating a much larger area of overall use by the entire population. Providing enough unbroken, suitable habitat is critical to the survival of pine snake populations in the state. HA is in the process of compiling data on the overall acreage necessary to support a viable population of pine snakes.

Table 5. Frequency Numbers, Sex, and Activity Ranges in Acres and Hectares for Northern Pine Snakes (*Pituophis melanoleucus*) at the New Jersey National Golf Course Property in Ocean County in 1992, The Nature Conservancy Sanctuary in Cumberland Co. between 1993 and 1994, and Lakehurst Naval Air Engineering Station, Ocean County, New Jersey in 1995.

| <u>Snake's Frequency</u> <u>Number</u> | <u>Sex of Snake</u> | <u>Activity Range in</u> <u>Acres</u> | <u>Activity Range in</u> <u>Hectares</u> |
|---|-------------------------|--|---|
| 273 | Male | 230.14 | 93.13 |
| 280 | Female | 93.02 | 31.61 |
| 722 | Female | 91.64 | 39.5 1 |
| 854 | Female | 188.29 | 76.20 |
| 418 | Female | 296.17 | 119.86 |
| 341 | Male | 398.88* | 161.42 |
| 770 | Male | 141.21 | 46.22 |
| 219 | Female | 55.39 | 22.41 |
| 245 | Female | 67.00 | 27.11 |
| 391 | Female | 91.53 | 37.04 |
| 417 | Female | 87.52 | 35.42 |
| 220 | Male | 70.28 | 28.11 |
| 246 | Female | 77.06 | 30.82 |
| 417 | Female | 60.72 | 24.29 |
| 341 | Female | 57.77 | 23.11 |
| 794 | Male | 49.70 | 19.88 |
| 3412 | Female | 54.24 | 21.69 |
| 946 | Male | 43.46* | 17.60 |
| 116 | Male | 114.60 | 46.40 |
| 471 | Male | 177.74 | 71.96 |
| 982 | Female | 178.72 | 72.36 |
| N = 21 | Sex Ratio = 8:13 | Mean: 125.29 | Mean: 50.10 |

Note: * = Largest nod smallest activity ranges in this sample.

All were calculated using the Convex Polygon Method.

Source: Herpetological Associates, Inc.

SUMMARY

The habitat evaluation conducted on the Aerohaven site during 2000 revealed that suitable habitat was present for both the **timber** rattlesnake and pine snake. Surveys for these species were initiated during 2001 to determine their presence or absence, as well as basic information about habitat use. Even though a road-killed timber rattlesnake was found on **Hopewell** Road during 2000, no timber rattlesnakes were found on the Aerohaven site. Since a known population of timber rattlesnakes is across **Hopewell** Road, it was thought that the Aerohaven site also serves as habitat. However, it appears unlikely that the Aerohaven site serves as important timber rattlesnake habitat. However, pine snakes were found on the Aerohaven site. Seven pine snakes were observed, and eight recently shed skins of pine snakes were also found. One adult female pine snake was radiotracked. Based on the random captures of pine snakes and the limited information gained from radiotracking, the disturbed fields on the study site appear to be an important habitat. Based on past research, it is likely that the surrounding forest also serves as habitat. The locations of den sites are unknown, but are likely to be present in the surrounding forest. The discovery of a nest and newly hatched pine snakes was also documented, and was considered a significant finding. Clearly, the Aerohaven site is critical breeding habitat for a colony of the State-threatened northern pine snake. A long-term conservation and management plan should be developed for this population of pine snakes.

Respectfully submitted,

HERPETOLOGICAL ASSOCIATES, INC.

LITERATURE CITED AND GENERAL REFERENCES

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APPENDICES

OWENS CORNING BERLIN PLANT
160 JACKSON ROAD
BERLIN, NEW JERSEY 08009
609.767.3300

September 20, 2000



Raymond Farrell
Regional Manager / Turtle Ecologist
Herpetological Associates, Inc.
31 Fayette Street
Staten Island, NY 10305

RE: Aerohaven Landfill, Evesham Township, NJ

Dear Mr. Farrell.

On Tuesday, September 12. It was brought to my attention by our maintenance contractor that he encountered you and two of your co-employees on our property in Evesham Township. The contractor stated that you had jumped the fence adjacent to the large sign which specifically states "No Trespassing Private Property" We would like to inform you that we are very serious in keeping trespassers off of our closed landfill.

At this time we would like a written response from you explaining your purpose for this intrusion. If you have a justifiable reason to enter our property in the future. I would be happy to escort you.

Sincerely

Steve Frame
Steve Frame
Project Manager

cc: Tom Merlino Owens Corning
Dave Palochko - Owens Corning

***Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -***

*Phone: 732-341-8822, Fax: 732-797-1583, E-mail: RZappalorti@aol.com
575 Toms River Road (Rt. 571), Jackson, New Jersey 08527*

September 28, 2000

Barbara J. Fegley, AICP, PP
Environmental Resolutions, Inc.
124 Gaither Drive, Suite 160
Mt. Laurel, New Jersey 08054-1719

Re: Letter from Owens Corning regarding HA's accidental trespassing on their property during our habitat evaluation of the AeroHaven site.

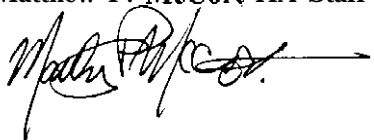
Dear Ms. Fegley:

Please read this letter from Steve Frame at Owens Corning. HA is ready to respond to this letter with an explanation of why we were there. The first day we surveyed the AeroHaven site, there was a gap in the fence that borders the adjacent property. The next time we were at the site we decided to survey the habitat on the other side of the fence because we thought it had potential for pine snakes. The gap in the fence had been repaired at this time. Myself and 2 other HA associates climbed over the fence and were met by the Owens Corning maintenance contractor immediately. He explained that the area was private property belonging to Owens Corning and not Evesham Township. HA immediately left the site. We were not aware that this property does not belong to Evesham Township and we apologized to the maintenance contractor.

If you have any suggestions for this letter, other than our explanation and apology, please contact me immediately. Thank you.

Sincerely,

Matthew P. McCort HA Staff Herpetologist



c: Robert T. Zappalorti, HA Executive Director
Raymond Farrell, HA Regional Manager
David Schneider, HA Assistant Herpetologist



***Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -***

*Phone: 732-341-8822, Fax: 732-797-1583, E-mail: RZappalorti@aol.com
575 Toms River Road (Rt. 571), Jackson, New Jersey 08527*

September 28, 2000

**Steve Frame, Project Manager
Owens Corning Berlin Plant
160 Jackson Road
Berlin, New Jersey 08009**

Re: Response to your September 20, 2000 letter regarding Herpetological Associates accidental presence on Owens Corning property.

Dear Mr. Frame:

On Tuesday, September 12, Herpetological Associates, Inc. (hereafter HA), was performing A habitat evaluation for Evesham Township on their property at the AeroHaven site. On September 7, when HA surveyed the Evesham Township AeroHaven site, there was a gap in the fence that runs across the site. On September 12 we decided, for the first time, to survey the habitat on the other side of the fence because we thought it had potential for pine snakes. The gap in the fence had been repaired at this time. Three HA associates, not having seen any signs and assuming that the property was part of the Evesham Township property, climbed over the fence and were met by the Owens Corning maintenance contractor immediately. He explained that the area was private property belonging to Owens Corning and not Evesham Township. HA immediately left the site. We were not aware that this property does not belong to Evesham Township and we sincerely apologize for this accidental intrusion.

HA greatly appreciates your offer to escort us onto your property in the future. If necessary, WC may take you up on that offer in the late spring, early summer of 2001 in order to look for pine snake nesting areas that could relate to our study on the Evesham Township property. If your assistance is needed we will contact you in advance to speak on this matter.

If you have any questions, please do not hesitate to contact me immediately at (732) 833-8600. Thank you.

Sincerely,

Robert T. Zappalorti, President/Executive Director

c: Raymond Farrell, HA Regional Manager
Matthew P. McCort, HA Staff Herpetologist
David Schneider, HA Assistant Herpetologist
Barbara Fegley, AICP, PP, Environmental Resolutions, Inc.



OWENS CORNING WORLD HEADQUARTERS

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DAVE PALOCHKO

DIRECTOR, ENVIRONMENTAL SERVICES

ENVIRONMENT, HEALTH & SAFETY



May 31, 2001

Mr. Robert T. Zappalorti
Executive Director/President
Herpetological Associates, Inc.
575 Toms River Road (Route 571)
Jackson, NJ 08527

Dear Mr. Zappalorti:

Thank you for your letter requesting access to our secure Aerohaven Landfill. This site is fenced under an administrative order, and we are not at liberty to provide access to members of the public.

We further trust that there will be no attempts to trespass on the site, as was done last year.

Sincerely,

A handwritten signature in cursive script that reads "David Palochko".

David Palochko
Director Environmental Services
Environment Health & Safety Department

/cfn

cc: Steve Frame - OC
Tom Merlino - OC

File copy

***Herpetological Associates, Inc. - Environmental Consultants
- Plant and Wildlife Specialists -***

Phone: 732-833-8600, Fax: 732-928-9257, E-mail: RZappalort@aol.com
575 Toms River Road (Route 571), Jackson, New Jersey 08527

May 30, 2001

Steve **Frame**, Project Manager
Owens Corning - Berlin Plant
160 Jackson Road
Berlin, New Jersey 08009

Re: Permission to enter Owens Corning's closed landfill site in **Evesham** Township to monitor the movements of a northern pine snake (*Pituophis melanoleucus*) and search for timber rattlesnakes (*Crotalus horridus*) HA File No. 2000.36.

Dear Mr. Frame:

Herpetological Associates, Inc. (hereafter HA), is an environmental consulting firm specializing in endangered and threatened plants and animals. We request permission for members of our staff to gain entry onto Owens Corning's closed landfill site on Kettle Run Road in **Evesham** Township, Burlington County, New Jersey to monitor the movements of a northern pine snake. HA under contract with **Evesham** Township to conduct intensive studies of the timber rattlesnake and northern pine snake at the proposed Aerohaven development site (Block 57, lot 1) which is located right next to your property. As part of this investigation we are radio-tracking an adult pine snake. Currently, we are monitoring the movements of a female pine snake that members of our staff captured at the Aerohaven site earlier this month and implanted with a transmitter. However, as of 5/28/01 it was discovered that the snake has moved onto your property. HA needs to be able to pinpoint the exact location(s), weekly movements, and habitat use of this state listed threatened species. It is therefore vital to our research that we have your cooperation in this matter, and would appreciate your permission to enter upon your property for our studies. Surveys need to be done between June and August 2001. HA staff would like to search once a week for snakes and radio-track the pine snake as long as it remains on your property. We carry all the necessary insurance policies required by law and if requested, will provide a "Certificate of Insurance" holding Owens-Corning harmless. We also ask if we could have a key to the gate, so we can drive our vehicles (2 Forest Green Dodge Durangos, New Jersey tag numbers HERP I and/or HERP II) onto the property with our equipment. If you have any questions, or need additional information, please do not hesitate to call upon me at 732-833-8600.

Sincerely,

HERPETOLOGICAL ASSOCIATES, INC.

Robert T. Zappalorti
Executive Director/President



Bog Turtle (*Clemmys muhlenbergii*)

*Pine Snake and Timber Rattlesnake Surveys
on the Aerohaven Site*



Northern Pine Snake (*Pituophis m. melanoleucus*)

Herpetological Associates, inc.

Plant and Wildlife Consultants
575 Toms River Road (Route 571)
Jackson, New Jersey 08527

732-833-8600